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EVALUATION OF PROCESSING TOMATO BREEDING LINES AND CULTIVARS FOR MECHANICAL HARVESTING AND QUALITY IN 1981

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Tomatoes are the most important processed crop in Ohio with a planting acreage of 15 thousand acres and over 250,000 ton production. New growing practices, machine harvest-bulk handling and new processing technology continue to create need for better suited varieties. This breeding work continues to be directed toward improvement of the whole-canned tomato (whole-pack), and other needs of the smaller canner in relation to this product, as well as development of improved varieties for use in the production of juice and sauce.

With increased direct seeding, greater emphasis is being given to seed germination cold tolerance. Selection for earliness and good fruit setting ability, especially during periods of heat stress, is being carried out to reduce the problem of split fruit set so as to broaden and make possible more uniform delivery schedules. Other important characteristics being worked on for more effective machine harvest and bulk handling, include crack resistance, firmness and ability of ripe fruit to store well on the vine for extended periods for maximum usable ripe fruit in once-over harvest. Thus in addition to increased productivity, a major objective, is more effective utilization of present yield, especially in regard to factors minimizing losses, due to overripe, rotted and green fruit. To reduce production costs, jointless pedicel (j2) is being incorporated to facilitate machine harvest and allow delivery of fruit free of stems.

Improved quality factors being selected for include: acidity, pH, soluble solids, viscosity, color [crimson fruit color (og^c) and high pigment fruit color (hp)], vitamin C, and especially fruit attributes conditioning efficient peeling characteristics and corelessness.

In 1981 there was an increase in commercial acreage planted of the machine harvest cultivar Ohio 7681 for early-main season production. Field results continued good with it and the commercial pack had good quality. Ohio 7681 acreage will increase in the Midwest in 1981. Commercial size seed lots are available from ADI Distributors, Inc., Carmel, Indiana. In 1981 there was an increase of commercial acreage planted with the new cultivar Ohio 7870 for harvest by hand or machine. This line was released as Ohio 7870 in June 1981 and commercial size seed lots of this variety are also available from ADI Distributors, Inc.

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* Assistance is acknowledged of Vegeteble Crops Branch Staff and the Horticulture Processing-Technology Assistants, OARDC.

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OHIO 7870

Ohio 7870 is an F6 generation selection derived from the following six crosses and selections therefrom: (Ohio 736 x Ohio 2070) X [[(C28 x H1547) x VF Roma] x Ohio 2070]] x VF 134. The line has early-main season maturity. Fruit size, concentration, uniformity of ripening make it suitable for machine harvest. It was evaluated in the Northern Tomato Exchange Program (NTEP) trials in 1979 and 1980 and in other tests as well in the mid-west and Canada, all of which indicated that it has good adaptability and commercial potential.

Vines of Ohio 7870 are medium in size, determinate (sp), and adapted to high population direct seed or transplant culture. The vines have not over-responded with excess growth to high fertility levels as sometimes occurs in standard varieties of similar maturity, making it more manageable for machine harvest. Adequate foliage cover enables good quality fruit development, yet the vines become uniformly semi-prostrate at maturity resulting in good bed coverage. Once-over yield has ranged to 30 tons usable fruit per acre in replicated trials. Fruits of Ohio 7870 are approximately 3 1/2 ounces in size, deep-plum shaped and uniform ripening (ur).

The line is resistant to Verticillium albo-atrum (verticillium wilt) (Ve) and Fusarium oxysporum f. lycopersici Race 1 (fusarium wilt) (I). Resistance to radial and concentric fruit cracking and ability of the fruit to withstand adverse soil moisture conditions allows on the vine field storage of fruit for extended periods with better yield recovery at harvest.

In OARDC as well as commercial trial, Ohio 7870 raw product, as well as processed product, is characterized by solids, acid, color, and vitamin C equal to or better than standards. It is suitable for the production of whole-canned tomato pack (whole-pack); small core and adaptability to lye or steam peeling allow efficient processing without coring in whole-pack production. It also can be utilized in juice, sauce, catsup and paste production.

New Promising Ohio Advanced Breeding Lines

The advanced Ohio lines, O 7814, O 7864, O 7868, O 7986, and O 79122 continued their good performance in 1981.

Ohio 7814, an early Fusarium resistant, jointless pedicel (j2), machine-harvest type, continued to exhibit potential in Center as well as commercial trials. It has good firmness and holding ability and is suitable for coreless wholepack and product. The line will be in extensive commercial trial acreage with several processors in 1982.

Ohio 7864 is also an early-mainseason, Verticillium-Fusarium resistant, machine harvest type line. It is suitable for product or coreless wholepack and will be continued in OARDC and commercial trial.

Ohio 7868 is a mainseason Verticillium-Fusarium resistant crimson (og^c) type which has exhibited potential in commercial trials for hand harvest, as well as machine harvest. It is firm and suitable for product or wholepack. It will be continued in OARDC and commercial trial.

Ohio 7986 is a mainseason, Verticillium-Fusarium resistant, freestemming line especially adapted to machine harvest and suitable for product and wholepack. It will be continued in OARDC and commercial trials.

Ohio 79122 is a machine-harvest type with high pigment (hp). It will be continued in trial in 1982.

New breeding lines are available which exhibit potential for improved productivity and quality over present varieties (Table 1). These lines will be further tested for commercial potential and are being used in further breeding to utilize higher levels of productivity and quality.

CULTURAL INFORMATION

Plants: Greenhouse-grown, 108 per standard flat from seed sown April 7.

Transplanted to Field: May 26, a two-row transplanter using 21-53-0 starter at 5 lb. per 100 gal. of water; 1/2 pint per plant.

Fertilizer: 800 lb. per acre of 9-26-26, October 23, 1980, 130 lb. per acre of 34-0-0, May 5, 1981.

Soil: Silty clay loam, fall bedded November 3.

Herbicide: Devrinol 1 lb. ai May 22; Sencor directed spray 0.38 lb. ai.

Plot Size and Spacing: One-row plots, 20 plants per row spaced 12 inches, rows 5 feet apart. Three replications.

Irrigation: None applied.

Insect and Disease Control: Air blast sprayer application according to recommendation as follows:

6 June	Guthion & Bravo
26 June	Sevin, Maneb & Kocide
2 July	Guthion, Copper & Maneb
15 July	Bravo, Maneb & Thiodan
23 July	Bravo, Maneb & Thiodan
30 July	Bravo
5 August	Bravo
13 August	Bravo, Kocide & Thiodan
21 August	Bravo & Copper
27 August	Maneb

Weather Data (Fremont, Ohio)

	Temperature		Rainfall (inches)	
	1981	27 Yr.Avg.	1981	27 Yr. Avg.
May	56.4	58.7	3.25	3.30
June	69.3	68.1	9.25	4.03
July	72.5	72.2	1.80	4.06
August	69.6	70.4	2.68	3.69
September	61.7	64.1	8.38	3.05

The weather in May was normal but planting conditions became poor toward the end of the month with excessive rainfall. Following planting in June, rainfall continued above normal. Flooding and relatively long periods of soil saturation produced plant damage. Dry stress conditions in July and August further reduced crop development and fruit size, resulted in much blossom-end rot, and delayed maturity. Cool temperatures and renewed excessive rainfall delayed ripening and caused much fruit rot.

Harvest Information

Harvesting was with an FMC Tomato Harvester and was carried out when the entries were estimated to be at a stage of fruit ripeness in which yields of marketable fruit were approaching optimum recovery (Table 1). Percentages reported of fruit recovery are on a weight basis.

The stresses of excess moisture, followed by drought and then heavy rain at harvest severely reduced ripe usable yield and created unusually large irregular areas of plant development in the trial. The lack of uniformity limits the usefulness of the yield results for comparison purposes. Yields from Ohio's commercial crop were similarly adversely effected.

QUALITY EVALUATION

Field run tomatoes were used for quality evaluation; the sample was cut in half, quartered, extracted in a Food Processing Equipment Co. Laboratory pulper, and de-aerated. All laboratory samples were harvested by hand on August 25 and evaluated on August 26.

1. Agtron E-5. Instrument calibrated at 48.

2. Hunter D-6 Tomato colorimeter (TCM).

3. Percent Soluble Solids. Abbe Refractometer.

4. Percent total acid as citric. The raw sample used for pH determination was directly titrated using 0.1 normal sodium hydroxide solution to a pH of 8.1.

5. pH was determined by the glass electrode method.

6. Vitamin C (ascorbic acid) standard procedure:

$$\text{Dye factor} \times \text{ml. of dye} \times 100 = \frac{\text{mgs. Vitamin C}}{100 \text{ gms}}$$

TABLE 1. Field and Laboratory Evaluation of Processing Tomato Varieties and Test Lines for Mechanical Harvest When Yields of Marketable Fruit Were Approaching Optimum Recovery, Vegetable Crops Branch, OARDC, Fremont, Ohio. 1981.*

Variety or Test Line	Seed source	Ripe Usable Tons/A	Ripe Usable % of potential	% of Potential cull	Fruit size (oz)	Stems %	Stems joint	pH	% Citric acid	% Soluble solids	Color Agtron E5	Color Hunter D6 TCM	Vit C mg/100 g
Harvest Date 8/25/81													
O 8138	1	13.4	73	3	2.4	5	j2	4.46	.39	5.0	35	72.9	18.0
O 7974	1	10.0	74	3	2.5	2	j2	4.25	.32	5.6	37	66.7	20.4
Harvest Date 9/9/81													
O 7814	1	17.7	85	7	2.3	8	j2	4.50	.34	5.1	34	68.8	18.0
US 77B68	10	15.1	69	6	2.4	39	+	----	---	---	--	----	----
Ohio 7681	1	14.7	64	16	4.2	94	+	4.45	.31	5.7	34	74.6	22.3
O 8178	1	14.0	80	10	2.1	1	j2	4.39	.26	5.7	35	69.2	24.0
O 8140	1	13.6	69	14	2.7	2	j2	4.42	.25	5.8	36	71.8	24.6
O 8188	1	13.6	78	11	2.3	1	j2	4.55	.29	6.0	33	71.4	31.0
O 7983	1	13.4	69	8	2.1	1	j2	----	---	---	--	----	----
CastleHY1508	3	12.4	63	15	2.3	2	+	----	---	---	--	----	----
O 8095	1	12.2	58	13	3.2	5	j2	4.45	.25	5.8	34	73.8	27.9
O 8152	1	11.0	67	11	3.1	6	j2	4.45	.36	5.4	31	75.8	22.8
Heinz 2653	5	10.2	65	11	2.2	2	j2	4.55	.34	5.2	35	72.9	22.8
Peto H 31	8	9.7	57	21	2.9	21	+	----	---	---	--	----	----
O 7955	1	9.5	73	9	2.1	8	+	4.40	.35	4.8	34	71.6	21.1
Harvest Date 9/14/81													
O 8172	1	14.7	77	11	2.4	3	j2	4.42	.38	5.8	36	72.8	25.4
O 8032	1	14.5	76	11	2.9	62	+	4.48	.32	5.2	33	73.9	18.6
Campbell 37	2	14.1	71	13	2.9	4	j2	4.42	.31	4.8	35	76.4	20.4
O 7981	1	14.0	79	8	2.2	3	j2	4.36	.33	4.6	34	69.6	27.0
O 8141	1	13.7	69	11	2.6	2	j2	4.40	.36	5.2	34	72.5	18.0
O 8159	1	13.5	71	14	2.5	2	j2	4.49	.34	5.4	34	72.4	21.0
O 79122	1	13.2	80	10	2.8	52	+	4.45	.36	4.9	33	76.3	19.2
O 8166	1	13.0	79	14	2.9	49	+	4.39	.41	5.6	33	76.9	19.8
Ohio 7870	1	12.8	74	8	2.8	56	+	4.40	.31	4.9	34	66.7	13.6
Campbell 4135	2	12.8	70	14	2.4	2	j2	4.38	.36	5.5	34	71.9	26.0

TABLE 1. Field and Laboratory Evaluation of Processing Tomato Varieties and Test Lines for Mechanical Harvest When Yields of Marketable Fruit Were Approaching Optimum Recovery, Vegetable Crops Branch, OARDC, Fremont, Ohio. 1981. (cont.)*

Variety or Test Line	Seed source	Ripe Usable Tons/A	Ripe Usable % of potential	% of Potential cull	Fruit size (oz)	Stems %	Stems joint	pH	% Citric acid	% Soluble solids	Color Agtron E5	Color Hunter D6 TCM	Vit C mg/100 g
Harvest Date 9/14/81 (cont.)													
Purdue 80A04	11	12.5	65	18	2.8	31	+	4.32	.32	5.4	33	72.6	24.8
O 7864	1	12.5	75	11	3.0	13	+	4.42	.34	5.4	32	73.0	15.0
O 8139	1	12.4	75	14	2.5	19	j2	4.42	.39	5.6	35	73.7	19.8
O 8038	1	12.4	72	14	2.6	2	j2	4.40	.34	5.2	38	65.8	19.9
O 7826	1	12.3	70	12	2.0	64	+	4.40	.31	4.8	37	70.4	21.7
O 8150	1	12.0	68	13	2.4	4	j2	4.40	.46	5.3	36	68.9	20.4
O 7986	1	11.5	75	10	2.4	18	+	4.39	.31	4.7	33	72.8	20.4
O 7868	1	11.5	77	10	2.7	54	+	4.45	.39	5.8	33	75.1	20.4
Heinz 722	5	11.3	73	11	2.1	0	j2	4.35	.38	5.2	37	72.1	24.0
O 7855	1	10.7	64	12	2.4	20	+	4.35	.41	5.5	36	71.0	19.8
O 8137	1	10.8	72	15	2.8	5	j2	4.48	.35	5.8	34	74.0	19.8
Peto 95	8	10.5	66	16	2.7	13	+	----	---	---	--	----	----
FME 6203	12	10.0	65	11	2.9	10	+	4.50	.38	5.8	36	74.0	20.4
O 8153	1	9.9	67	13	2.9	2	j2	4.50	.33	6.0	34	71.5	22.8
O 801696	1	9.0	72	17	2.7	11	j2	4.45	.32	5.7	33	76.5	19.8
VF 134-1-2	3	8.4	61	9	2.6	82	+	4.40	.35	5.2	35	69.5	24.0
LSD @5%		4.1			0.4								

*All laboratory evaluations on raw product from hand harvested samples 8/26/81

TABLE 2. Evaluation of 1981 N.T.E.P. (Northern Tomato Exchange Program), OARDC, Wooster, Ohio (Rating Score: 5=Excellent; 1=Poor).

NTEP Entry No.	Cultivar	Source	Earliness	Cover	Set Concentration	Fruit Size	Firmness	Cracking	Separation	Styler scar	Internal color	Coreless Whole-pack
8101	US80B119	10	3	3	5	4	3	3	3	5	3	5
8102	Ohio 7986	1	4	3	5	3	4	5	4	5	4	5
8103	81NC111	6	3	3	5	2	3	2	5	3	3	5
8104	Ont 7923	7	4	2	4	4	3	3	4	4	5	3
8105	81NC114	6	1	4	5	4	2	4	2	5	3	4
8106	Ohio 7814	1	4	4	5	3	4	5	4	5	4	5
8107	US80B110	10	1	5	4	4	4	4	4	5	3	4
8108	PU80-33	11	2	5	3	2	4	4	5	5	5	5
8109	Ont 8021	7	3	4	4	3	4	3	3	2	4	4
8110	81NC110	6	1	5	3	4	3	5	3	4	3	5
8111	Ohio 7870	1	3	4	5	4	4	4	4	5	4	3
8112	Ont 8016	7	4	2	3	4	3	3	2	4	5	4
8113	US80B132	10	1	4	4	4	3	3	2	5	2	5
8114	Campbell 37	4	3	3	3	3	3	3	3	3	3	2
8115	NY80-36	9	4	2	2	3	2	2	3	4	5	2
8116	PU80-70	11	3	3	4	3	3	3	3	4	5	5
8117	81NC113	6	2	5	3	3	2	3	4	4	5	5
8118	Ohio 8038	1	5	3	4	3	4	4	4	4	4	4
8119	Ont 744-3	7	4	2	3	5	3	2	2	3	4	1
8120	NY77-459	9	3	3	2	3	3	2	4	3	3	2
8121	PU80-26	11	4	4	5	3	4	3	4	3	3	5
8122	H 1036	5	4	3	4	5	4	3	2	4	2	2
8123	Ont 7713	7	5	2	3	2	2	3	4	5	4	5
8124	PU80-62	11	3	3	4	4	4	3	2	3	4	4
8125	81NC112	6	2	4	3	3	4	5	5	5	4	4
8126	Ohio 7868	1	3	4	5	5	5	5	4	4	5	3

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